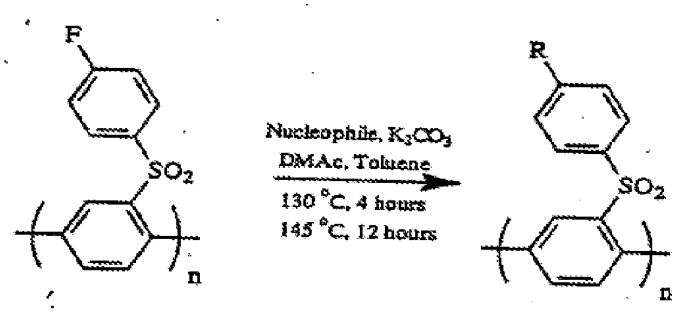
REMARKS

At the outset, the Examiner is thanked for the thorough review and consideration of the pending application. The Final Office Action dated March 16, 2010 has been received and its contents carefully reviewed. Claims 1-15 are currently pending. Reexamination and reconsideration of the pending claims are respectfully requested.

The Office Action rejects claims 1, 3, 4, 7, 8, 11, and 15 under 35 U.S.C. §103(a) as being unpatentable over Bloom et al. Polymer Preprints, ACS 40(2): 567-568 (*Bloom*) in view of PCT Application Publication No. WO 01/70858 to Charnock et al. (*Charnock*). Applicants respectfully traverse the rejection.

To establish *prima facie* obviousness of a claimed invention, all the elements of the claim must be taught or suggested by the prior art. The combined teaching of *Bloom* and *Charnock* fails to teach or suggest all the elements of claims 1, 3, 4, 7, 8, 11, and 15, and thus cannot render these claims obvious.

Claim 1 recites, "a polymer, the skeleton of which consists of at least one phenylene repeating unit of formula (I) ...and ... at least one phenylene repeating unit of formula (II)." *Bloom* fails to teach or suggest at least this element of claim 1. *Bloom* does not describe that the groups grafted by nucleophilic substitution contain acid moieties as defined in claim 1. *Bloom* also does not disclose that the polymers mentioned therein are fitted to constitute membrane of fuel cell. In addition, *Bloom*, in scheme 1, discloses Ni(0) catalyzed synthesis of poly(paraphenylene). Scheme 1 is reproduced below.



Scheme 1 includes two formulae. One of them (formula on the left) is the stating material, and the other (formula on the right) is the product. The product (formula on the right) has only one phenylene repeating unit. Because the polymer of claim 1 consists of at least one phenylene repeating unit of formula (I) and at least phenylene repeating unit of formula (II), *Bloom* can not possibly teach or suggest the above-recited element of claim 1. Additionally, as admitted by the Office Action, "Bloom et al. does not teach the functional group as being one of claimed acids." *Office Action*, page 5.

The Office Action further states "Bloom et al. teaches the substitute would be less than quantitative, thereby leaving units of the fluorinated precursor (Conclusion). Therefore, the final product would contain units of both [formulae]." *Office Action*, page 6. Applicants respectfully disagree. *Bloom* discloses that "[d]isplacement of fluorine in poly(4'-fluoro-2,5-diphenyl sulfone) by the various nucleophiles occurred with nearly quantative substitution by GPC. Theoretical molecular weights based on 100% substitution have been compared to the GPC results for all derivatives in Table 1." *Bloom*, page 1630, left column, emphases added. There is no indication that the final product would contain units of both formulae. The Office's reasoning is flawed and without factual support from *Bloom*.

Charnock does not cure the deficiency of *Bloom*. *Charnock* is silent with respect to the above-recited element of claim 1. Specifically, *Charnock* discloses composite ion-exchange material including a first conductive polymer and a support material for the first conductive polymer, wherein the support material includes a second conductive polymer. *Charnock* provides examples for the first conductive polymer and second conductive polymer. These two conductive polymers are in fact a mixture of coplymers, while the polymer of claim 1 includes a skeleton consisting of coexisting repeating units of Formula (I) and Formula (II). Accordingly, the two conductive polymers have different structures from the polymer of claim 1, and thus cannot render the polymer of claim 1 obvious.

The Office Action alleges that *Charnock* teaches a sulfonated, phosphorylated, or carboxylated poly-1,4-phenoxybenzoylphylene and *Bloom* and *Charnock* "are combinable as they are concerned with the same field of endeavor, namely substituted poly-1,4-phenoxybenzoylphenylene." *Office Action*, page 3. Applicants respectfully disagree. Bubstituted poly-1,4-phenoxybenzoylphenylene is a chemical, phenylene polyer, and the fact

that *Bloom* and *Charnock* both disclose phenylene polymer does not put them in the same field of endeavor. The polymers of *Bloom* and the polymers of *Charnock* are synthesized and used for completely different purposes. *Bloom* relates to the synthesis of poly(paraphenylene) via Ni(0) catalyzed coupling as high performance materials (excellent high temperature stability), and *Charnock* relates to a composite ion-exchange material. Stated simply, the polymers disclosed in *Bloom* and the polymers disclosed in *Charnock* serve completely different purposes and solve completely different problems.

More importantly, even if *Bloom* and *Charnock* were combinable, one of ordinary skill in the art would not have been able to obtain "a polymer, the skeleton of which consists of at least one phenylene repeating unit of formula (I) ...and ... at least one phenylene repeating unit of formula (II)" of claim 1. Instead, the combined *Bloom* and *Charnock* would result in a mixture of copolymers as defined in *Bloom* and the copolymers as defined in *Charnock*. The alleged combination would not result in a copolymer comprising, in its skeleton, the intercalation of units of formula (I) and units of formula (II).

Furthermore, claim 1 recites, "at least one of the groups R_4, R_5, R_6, R_7 and R_8 represents a group chosen from -SO_3H, -PO_3H_2 and -CO_2H groups, perfluoroalkyl groups, perfluoroalkylaryl groups optionally comprising in their chain one or more oxygen, nitrogen and/or sulfur atoms, perfluoroaryl groups and -O-perfluoroaryl groups, these perfluoro groups bearing a group chosen from -SO_3H, -PO_3H_2 and -CO_2H." While formulae 1 and 2 of claim 1 include multiple aromatic rings, groups R_4, R_5, R_6, R_7 and R_8 are all located on one phenyl group in formula 1. *Charnock* only discloses that "to provide said ion exchange sites, said polymer is sulphonated, phosphorylated, carboxylated, quaternary-aminoalkylated or choromethylated, and optionally further modified." *Charnock*, page 5, lines 5-8. *Charnock*, however, does not teach or suggest where in the polymer the acid groups be located. Without this information, it is impossible for one of ordinary skill in the art to combine *Bloom* and *Charnock* to arrive at the polymer of claim 1, as suggested by the Office Action.

The Office Action further states that "Bloom et al. teaches that the subsituent is located on the nucleophile that is attached to the polymer backgone (Scheme 1)." *Office Action*, page 7. Again, Applicants respectfully disagree. The subsistent in Scheme is an R group, and the R group is not "a group chosen from -SO_3H, -PO_3H_2 and -CO_2H groups, perfluoroalkyl groups,

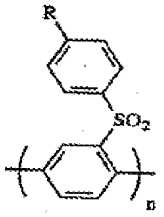
perfluoroalkylaryl groups optionally comprising in their chain one or more oxygen, nitrogen and/or sulfur atoms, perfluoroaryl groups and -O-perfluoroaryl groups, these perfluoro groups bearing a group chosen from $-SO_3H$, $-PO_3H_2$ and $-CO_2H$." There is no teaching or suggest that the R group could be replaced by "a group chosen from $-SO_3H$, $-PO_3H_2$ and $-CO_2H$ groups, perfluoroalkyl groups, perfluoroalkylaryl groups optionally comprising in their chain one or more oxygen, nitrogen and/or sulfur atoms, perfluoroaryl groups and -O-perfluoroaryl groups, these perfluoro groups bearing a group chosen from $-SO_3H$, $-PO_3H_2$ and $-CO_2H$." In fact, the Office admits that "Bloom et al. does not teach the functional group as being of the claimed acids." *Office Action*, page 3. Because *Bloom* does not doest teach the function group as being of the claimed acids, *Bloom* does not and cannot possibly teach where the acids are located. Thus, the Office's reasoning is again flawed and without factual support.

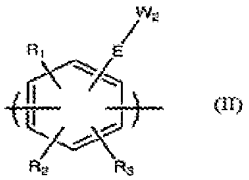
Accordingly, claim 1 is allowable over the combined teaching of *Bloom* and *Charnock*. Claims 3, 4, 7, 8, 11, and 15 variously depend from claim 1, and are also allowable for at least the same reasons as claim 1. Applicants, therefore, respectfully request withdrawal of the 35 U.S.C. §103(a) rejection of claims 1, 3, 4, 7, 8, 11, and 15.

The Office Action rejects claims 1-5, 7, 8, and 12-14 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent Application Publication No. 2002/0172850 to Asano et al. (*Asano*) in view of Bloom et al. Macromolecules, 2001, 34, 1627-1633 (*Bloom II*) as evidenced by PCT Application Publication WO 01/42336 to Cui et al. (*Cui*) and *Bloom*. Applicants respectfully traverse the rejection.

Claim 1 recites, "a polymer, the skeleton of which consists of at least one phenylene repeating unit of formula (I) …and … at least one phenylene repeating unit of formula (II)." *Asano* fails to teach or suggest at least this element of claim 1. In fact, the Office admits that "Asano et al. does not teach a repeat unit of formula II." *Office Action*, page 6. Moreover, *Asano* discloses "to establish a means of alleviating the rigidity of this linear molecular structure … this cab be achieved by using a polymer electrolyte formed from a sulfonated polyarylene polymer in combination with another polymer electrolyte" and the "another polymer electrolyte" is also a sulfonated polymer. *Asano*, ¶¶0023, 0024, 0042, 0060. In claim 1, only groups R_4, R_5, R_6, R_7 and R_8, in Formula I can be a $-SO_3H$ group, and no group in Formula II can be a $-SO_3H$ group. Because *Asano* teaches the combination of two sulfontated polymers, *Asano* in fact

teaches away from using polyarylene electrolytes having a skeleton comprising only phenylene units in their main chain, as required by claim 1, because of the rigidity of the structure generated by skeleton comprising only phenylene units in their main chain. In addition, *Asano* deals with a principle, which is different from the principle of the present invention. *Asano* teaches using two different copolymers to constitute a composite material for membrane, while the present invention discloses that the copolymers can be directly formed in thin film and constitute membrane.

Bloom and *Bloom II* are two similar papers published by the same authors, and they do not cure the deficiency of *Asano*. *Bloom* and *Bloom II* discloses the synthesis of poly(paraphenylene) via Ni(0) catalyzed coupling. Specifically, *Bloom* and *Bloom II* disclose the synthesis of the polymer with the following structure: 

, wherein R is SMe, NRR' or O-Aryl. In other words, the substituent on the -SO_2- is -phenylene-S-Me, -phenylene-NRR' or -phenylene-O-Aryl. Claim 1 recites Formula II 

(II)
, wherein the group E represents a single bond or a group chosen from –(C=O)-, -P(=O)- and -SO_2-; the group W_2 represents an aryl group substituted with at least one substituent chosen from F, -O-SO_2-Aryl, -S(=O)-Aryl or represents a perfluoroaryl group. Note that group W_2 in Formula II can not be -phenylene-S-Me, -Phenylene-NRR', or -Phenylene-O-Aryl. Therefore, the polymer structure disclosed in *Bloom* and *Bloom II* cannot render Formula II of claim 1 obvious.

Furthermore, the polymers of *Bloom* and *Bloom II* and the polymers of *Asano* are synthesized and used for completely different purposes. *Bloom* and *Bloom II* relate to the synthesis of poly(paraphenylene) via Ni(0) catalyzed coupling as high performance materials (excellent high temperature stability), and *Asano* relates to "providing a cheap composite

polymer electrolyte membrane which permits of excellent adhesion to the electrodes when employed in solid polymer electrolyte fuel cell, and a solid polymer electrolyte fuel cell which utilizes the composite polymer electrolyte membrane." *Asano*, ¶0018. The polymers disclosed in *Bloom* and *Bloom II* and the polymers disclosed in *Asano* serve completely different purposes and solve completely different problems.

Cui does not cure the deficiency of *Asano*, *Bloom*, and *Bloom II*. The Office Action only cites *Cui* for disclosing "use of sulfonating agents as in Asano et al. can result in long reaction times and polymer degradation." *Office Action*, page 7. *Cui* is also silent with respect to the above-recited elements of claim 1.

Moreover, the Office combines different parts of four references (*Asano*, *Bloom*, *Bloom II*, and *Cui*) like the pieces of a jigsaw, whose pieces are not compatible with each other. As a result, the alleged combination is not a copolymer whose skeleton comprises the coexistence of units of formula (I) and units of formula (II), but a mixtures of copolymers as separately `defined in *Asano*, *Bloom*, *Bloom II*, and *Cui*.

Accordingly, claim 1 is allowable over the combined teaching of *Asano*, *Bloom*, *Bloom II*, and *Cui*. Claims 2-5, 7, 8, and 12-14 variously depend from claim 1, and are also allowable for at least the reasons as claim 1. Applicants, therefore, respectfully request withdrawal of the 35 U.S.C. §103(a) rejection of claims 1-5, 7, 8, and 12-14.

The Office Action rejects claims 6, 9, and 10 under 35 U.S.C. §103(a) as being unpatentable over *Asano* in view of *Bloom II* as evidenced by *Cui*, *Bloom*, and U.S. Patent No. 6,025,092 to Doyle et al. (*Doyle*). Applicants respectfully traverse the rejection.

Claims 6, 9, and 10 variously depend from claim 1, and incorporate all the elements of claim 1. As discussed, the combined teaching of *Asano*, *Bloom*, *Bloom II*, and *Cui* fails to teach or suggest at least the above-recited elements of claim 1, namely, "a polymer, the skeleton of which consists of at least one phenylene repeating unit of formula (I) ...and ... at least one phenylene repeating unit of formula (II)." *Doyle* does not cure the deficiency of *Asano*, *Bloom*, *Bloom II*, and *Cui*. The Office Action only cites *Doyle* for disclosing a pendant group in an ion exchange membrane. Office Action, pages 7-8. *Doyle* is also silent with respect to the above-

recited elements of claim 1. Accordingly, claim 1 and its dependent claims 6, 9, and 10 are allowable over the combined teaching of *Asano*, *Bloom*, *Bloom II*, *Cui*, and *Doyle*. Applicants, therefore, respectfully request withdrawal of the 35 U.S.C. §103(a) rejection of claims 6, 9, and 10.

The application is in condition for allowance. Early and favorable action is respectfully solicited. If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at (202) 496-7500 to discuss the steps necessary for placing the application in condition for allowance. All correspondence should continue to be sent to the below-listed address.

If these papers are not considered timely filed by the Patent and Trademark Office, then a petition is hereby made under 37 C.F.R. §1.136, and any additional fees required under 37 C.F.R. §1.136 for any necessary extension of time, or any other fees required to complete the filing of this response, may be charged to Deposit Account No. 50-0911. Please credit any overpayment to deposit Account No. 50-0911. A duplicate copy of this sheet is enclosed.

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Respectfully submitted,

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